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主　論　文　要　旨

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主 論 文 題 名：

Social Choice and Measurement

（内容の要旨）

This thesis consists of four essays on social choice and measurement. I study various “aggregation rules” such as voting rules, electoral systems, aggregation formulas of Human Development Index, and measures of population ageing. These are functions that aggregate “many” to “one”. For example, voting rules aggregate different individual preferences and choose one alternative from others. Similarly, a measure of population ageing is a function that maps individual ages to one real number that indicates the level of population ageing in a society.

In Chapter 1, I propose a voting rule based on cosine similarity. Cosine similarity is a commonly used similarity measure in computer science. I apply this similarity measure to define a voting rule, namely, the cosine similarity rule. This rule selects a social ranking that maximizes cosine similarity between the social ranking and a given preference profile. Our main finding is that the cosine similarity rule in fact coincides with the Borda rule.

In Chapter 2, I study electoral systems in representative democracies. I define an electoral system as a function that maps each preference profile to the distribution of seats among political parties in the congress or legislative chambers. My purpose is to search for electoral systems in which the distribution of seats in the congress can appropriately reflect preferences of the people in the nation. I introduce two consistency conditions for electoral systems, *Condorcet consistency* and *Borda consistency*. I first present a paradox of single-member district systems, namely, the Loser Dominance Paradox, which exhibits difficulty in the consistent aggregation of preferences of the people. Next, I show that single-member district systems and simple proportional representation systems violate both consistency conditions. Finally, I propose a new electoral system, namely, the *Borda proportional representation system* and show that it satisfies both consistency conditions.

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In Chapter 3, I propose a new approach for multidimensional evaluation when achievements in different dimensions are not easily comparable. Our approach can be applied to measurements of well-being based on capability approach such as human development or multidimensional poverty. In measurements of such things, we should respect (i) monotonicity to each achievement and (ii) incomparability across different dimensions. However, any method currently in use does not respect (i) or (ii). I introduce a new axiom *dimensional independence* that captures incomparability across different dimensions. Then, I propose new methods for multidimensional evaluation and show that our methods satisfy both of monotonicity and dimensional independence. Moreover, in a certain class of methods, I find a unique method that satisfies monotonicity, dimensional independence, and minimal lower boundedness. I apply this method for measurement of human development and compute new human development indices of 188 countries.

In Chapter 4 (co-authored with Yuta Nakamura and Noriaki Okamoto), we study the measurement of population ageing. Population ageing is one of the most serious problems in many developed countries. The level of population ageing is often measured by "usual" measures such as the share of the older population, mean age, median age, and the dependency ratio. However, these measures violate elementary properties for measuring population ageing. We propose a new measure of population ageing that overcomes drawbacks of the measures currently in use. We introduce a new condition called the *working age principle*, which is a sensitivity condition to thickness of the working age population. Our measure is the only measure that satisfies monotonicity, continuity, separability, normalization, and the working age principle.